

8 a source region formed along the surface region and having a second conductivity
9 type; and
10 a drain region formed along the surface region and having a second conductivity
11 type, said gate structure, source region and drain region configured to form an operable
12 field effect transistor, said source region and said drain region self-aligned with the gate
13 structure.

1 7. The device of claim 6 wherein the insulative layer comprises Ta_2O_5 .

1 8. The device of claim 6 further including a layer of SiO_2 disposed between the
Subt a³ insulative layer and the surface region.

✓ 1 9. A semiconductor device comprising:

2 a semiconductor material of a first conductivity type having a surface region for
3 formation of devices;

4 a field effect transistor gate structure formed on the surface region, comprising a
5 conductive layer and an insulative layer having a dielectric constant greater than 5
6 relative to free space, the insulative layer formed between the conductive layer and the
7 surface region; and

8 a source region and a drain region each formed in the surface region, aligned with
9 the gate structure and on a different side of the gate structure,

10 said gate structure, source region and drain region configured to form a field
11 effect transistor characterized by a gate leakage current less than $0.1 \text{ amp per cm}^{-2}$ during
12 operation.

1 10. The device of claim 9 wherein the field effect transistor is characterized by a
2 gate leakage current less than $10 \text{ milliamps per cm}^{-2}$ during operation.

1 11. The device of claim 9 wherein the field effect transistor is characterized by a
2 gate leakage current less than one milliamp per cm^{-2} during operation.

1 12. A method for manufacturing a semiconductor electronic product comprising:
2 providing semiconductor material having a surface region;
3 providing dopant to a portion of the surface region;
4 irradiating the portion of the surface region with sufficient energy to induce
5 diffusion of the dopant from the portion of the surface region to another region of the
6 semiconductor material.

1 13. The method of claim 12 wherein the step of irradiating elevates the
2 temperature of the portion of the surface region to render the dopant soluble in the
3 semiconductor material.

1 14. The method of claim 12 wherein the step of irradiating renders the portion of
2 the surface region liquid.

1 15. The method of claim 13 wherein the step of irradiating renders a portion of the
2 semiconductor material including said portion of the surface region liquid and results in
3 diffusion of the dopant about the liquid portion without electrically significant amounts of
4 the dopant diffusing out of the liquid portion to other portions of the semiconductor
5 material.

1 16. The method of claim 12 including the step of allowing the liquid region to
2 solidify.

1 17. A method for controlling movement of a dopant species in a semiconductor
2 material comprising:

3 providing semiconductor material having a plurality of adjoining regions with a
4 surface for formation of electronic devices;

5 introducing the dopant species along the surface of a first of the regions of the
6 semiconductor material;

7 elevating the temperature of the first region of the semiconductor material relative
8 to the temperature of a surrounding region of the semiconductor material such that the
9 dopant diffuses within at least a portion of the first region.

1 18. The method of claim 17 wherein upon elevation of the temperature in the first
2 region the temperature of the surrounding region remains lower than the minimum
3 temperature required to effect thermal diffusion of the dopant species in the surrounding
4 region.

1 19. The method of claim 17 wherein elevation of the temperature in the first
2 region is of such limited time duration as to preclude diffusion of electrically significant
3 amounts of the dopant species into the surrounding region.

1 20. A method for manufacturing a semiconductor electronic product comprising:

2 providing semiconductor material having a surface region with a layer of SiO₂
3 formed thereon and a layer comprising a metal also formed thereon;
4 providing dopant to a portion of the surface region;
5 irradiating the surface region so that the portion of the surface region containing
6 the dopant absorbs sufficient radiation to diffuse the dopant into another portion of the
7 semiconductor material while at least one of the layers formed on the surface region
8 reflects radiation.

1 21. The method of claim 18 wherein the layer of metal comprises tungsten
2 silicide.

1 22. A method for manufacturing an electronic product including a field effect
2 transistor, comprising:

3 providing semiconductor material of a first conductivity type having a surface and
4 two spaced-apart regions along the surface for receiving dopant of a second conductivity
5 type;

6 forming a field effect transistor gate structure along the surface and over a third
7 region of the surface between the two spaced-apart regions;

8 providing dopant to the spaced-apart regions;

9 heating the spaced-apart regions with laser radiation.

1 23. A method for manufacturing an electronic product including a field effect
2 transistor, comprising:

3 providing semiconductor material of a first conductivity type having a surface and
4 two spaced-apart regions along the surface for receiving dopant of a second conductivity
5 type;

6 forming a field effect transistor gate structure along the surface and over a third
7 region of the surface between the two spaced-apart regions;

8 providing dopant to the spaced-apart regions;

9 heating the spaced-apart regions by applying radiation of a wavelength which is
10 capable of being absorbed by the spaced-apart regions and reflected by a portion of the
11 gate structure.

12